

# Expanding NASA’s Land, Atmosphere Near real-time Capability for EOS (LANCE)

*Diane Davies<sup>1,2</sup>, Karen Michael<sup>3</sup>, Ed Masuoka<sup>3</sup>, Gang Ye<sup>2</sup>, Jeffrey Schmaltz<sup>2</sup>, Sherry Harrison<sup>4</sup>, Daniel Ziskin<sup>5</sup>, Phil B Durbin<sup>6</sup>, Steve Protack<sup>2</sup>, Pamela Livingstone Rinsland<sup>7</sup>, Daniel A. Slayback<sup>2</sup>, Frederick S. Pollicelli<sup>3</sup>, Otmar Olsina<sup>2</sup>, Gary Fu<sup>3</sup>, Gregory Ederer<sup>3</sup>, Feng Ding<sup>6</sup>, Jessica Braun<sup>8</sup>, Liam Gumley<sup>8</sup>, Elaine Prins<sup>8</sup>, Carol C. Davidson<sup>2</sup> and Min Minnie Wong<sup>2</sup>*

*1-Trigg-Davies Consulting Ltd, 2- Science Systems and Applications, Inc, 3 - NASA Goddard Space Flight Center, 4- The University of Alabama in Huntsville, 5- National Center for Atmospheric Research , 6-ADNET Systems Inc, 7-NASA Langley Research Center 8- University of Wisconsin-Madison, Space Science and Engineering Center (SSEC)*

## Abstract

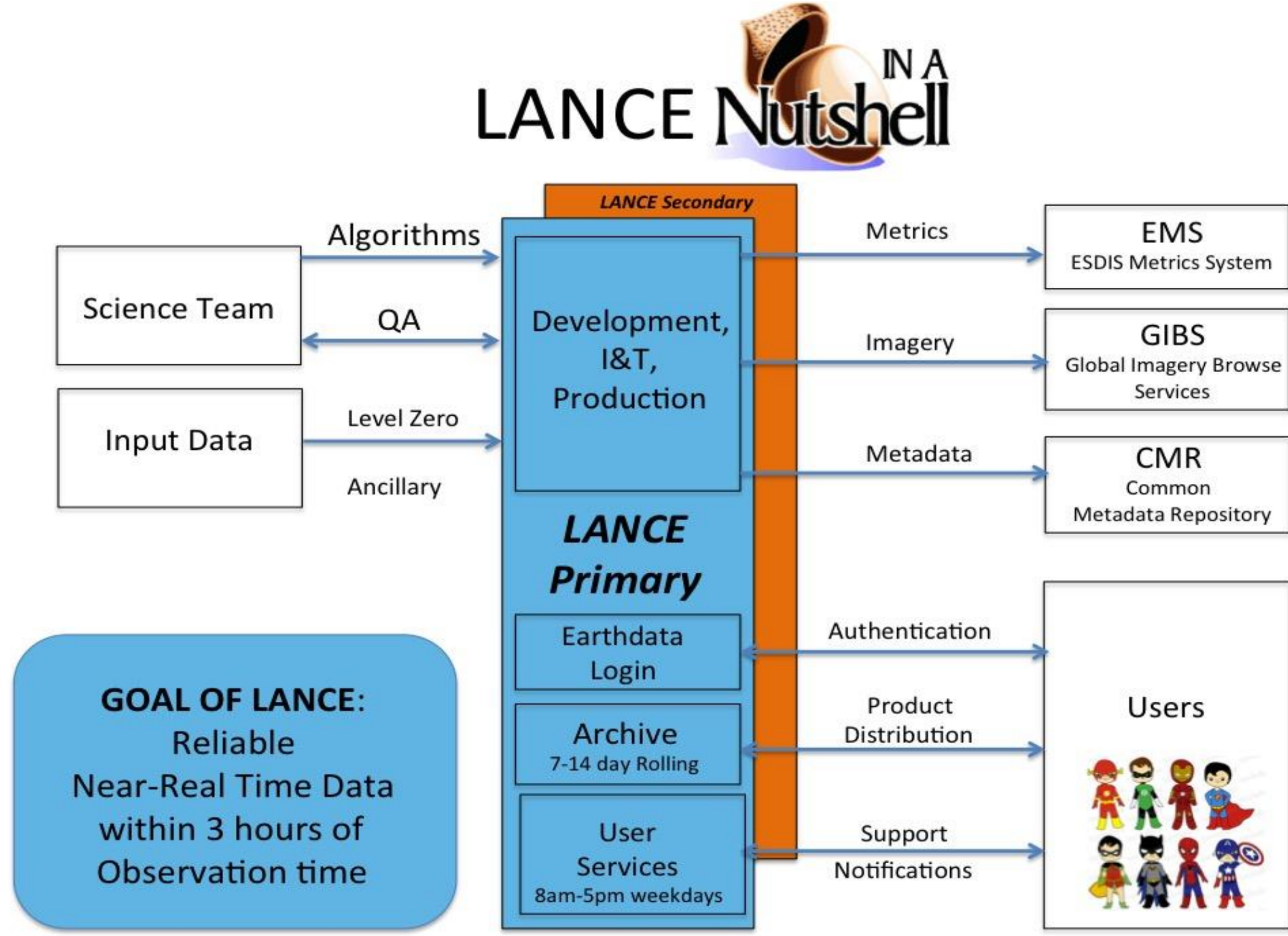
NASA’s Land, Atmosphere Near real-time Capability for EOS (LANCE) is a virtual system that provides near real-time EOS data and imagery to meet the needs of scientists and application users interested in monitoring a wide variety of natural and man-made phenomena in near real-time. Over the last year: near real-time data and imagery from MOPITT, MISR, OMPS and VIIRS (Land and Atmosphere) have been added; the Fire Information for Resource Management System (FIRMS) has been updated and LANCE has begun the process of integrating the Global NRT flood and Black Marble products. In addition, following the AMSU-A2 instrument anomaly in September 2016, AIRS-only products have replaced the NRT level 2 AIRS+AMSU products. This presentation provides a brief overview of LANCE, describes the new products that are recently available and contains a preview of what to expect in LANCE over the coming year. For more information visit: <https://earthdata.nasa.gov/lance>

## LANCE Near Real-Time Products

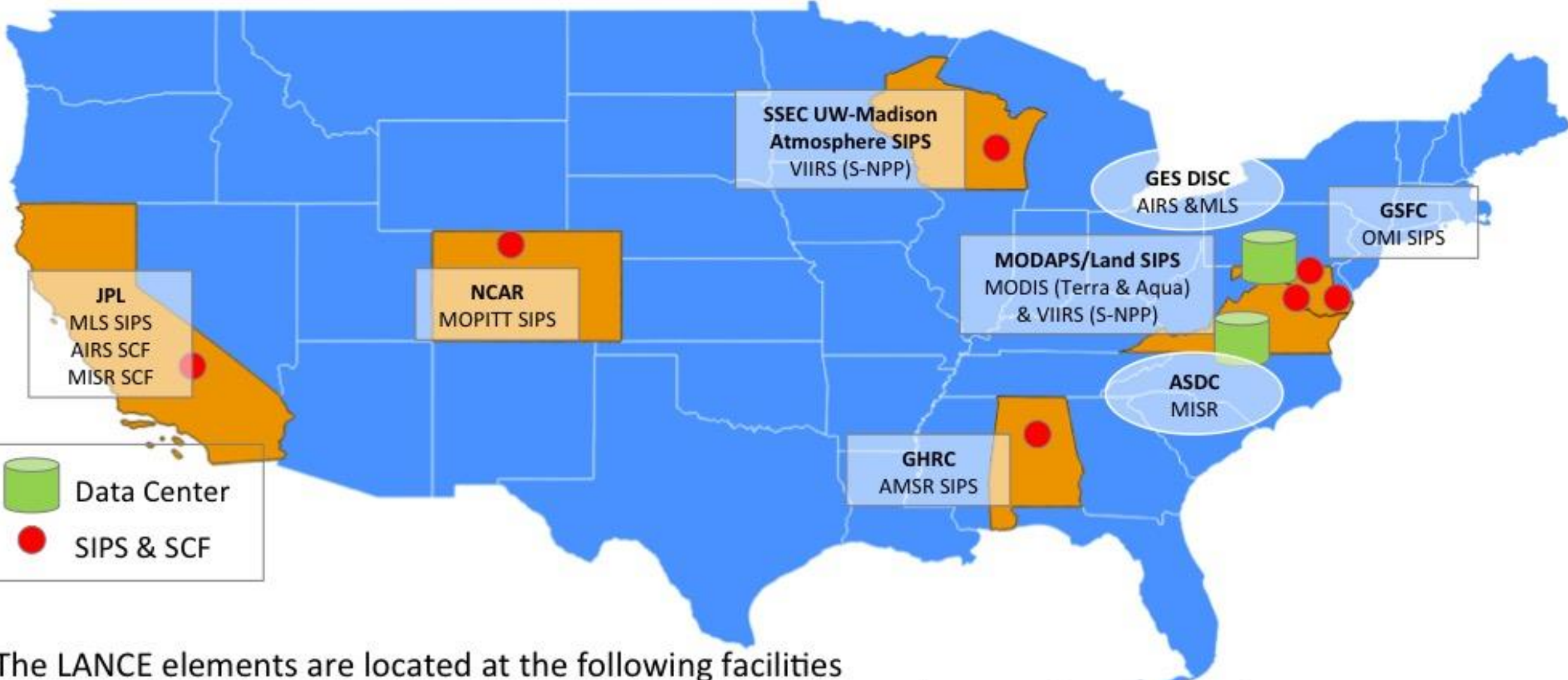
Table 1: LANCE NRT Products

Instrument	Platform	Product Categories	Average Latency
Atmospheric Infrared Sounder (AIRS)	Terra	Radiances, Temperature, Moisture Profiles, Precipitation, Dust, Clouds and Trace Gases	75 - 140 minutes
Advanced Microwave Scanning Radiometer 2 (AMSR2)	Global Change Observation Mission – Water 1 (GCOM-W1) – a Japanese Earth Observation Satellite	Global Total Precipitation, Global Rainfall, Total Precipitable Water (TPW), Ocean Wind Speed (OWS), Columnar Cloud Liquid Water (CLW) over ocean, Columnar Water Vapor (CWV) over ocean, Snow Water Equivalent (SWE), Sea Ice Concentration, Brightness Temperature (Tb), Soil Moisture	75 – 165 minutes**
Multi-angle Imaging SpectroRadiometer (MISR)	Terra	Cloud motion vectors (Winds), Radiances	90 - 120 minutes
Microwave Limb Sounder (MLS)	Aura	Ozone, Temperature, Carbon Monoxide (CO), Water Vapor, Nitric Acid, Nitrous Oxide (N <sub>2</sub> O), Sulfur Dioxide (SO <sub>2</sub> )	75 - 140 minutes
Moderate Resolution Imaging Spectroradiometer (MODIS)	Terra	Radiances, Clouds/Aerosols, Water Vapor, Fire, Snow Cover, Sea Ice, Land Surface Reflectance, Land Surface Temperature	60 - 125 minutes*
Measurements of Pollution in the Troposphere (MOPITT)	Terra	Retrieved CO (Thermal Infrared Radiances)	180 minutes
Ozone Mapping and Profiler Suite (OMPS)	NASA/NOAA Suomi National Polar-orbiting Partnership (S-NPP)	Total Column Ozone and Aerosol Index, SO <sub>2</sub> , Ozone Profile	180 minutes
Ozone Monitoring Instrument (OMI)	Aura	Ozone, SO <sub>2</sub> , Aerosols, Cloud Top Pressure	100 - 165 minutes**
Visible Infrared Imaging Radiometer Suite (VIIRS)	S-NPP	375 m Active Fire, Corrected Reflectance Imagery, Land Surface Reflectance Coming soon: Snow, Land Surface Temperature, Sea Ice and Ice Surface Temperature	180 minutes

\* Latency excludes daily Land Surface Reflectance \*\* Latency excludes Level 3 products



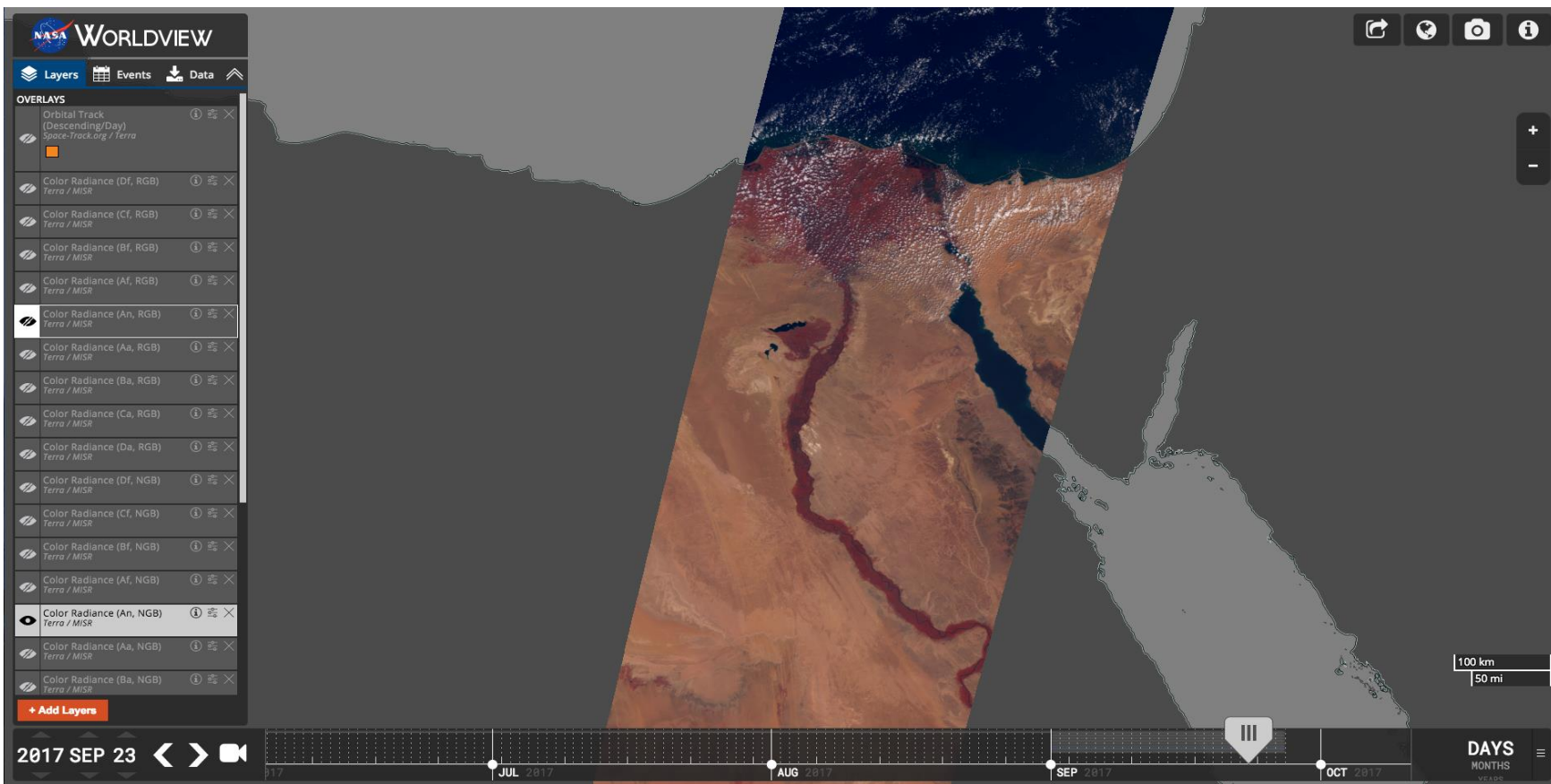
## LANCE FACILITIES



- The LANCE elements are located at the following facilities
- **GSFC Earth Sciences Data and Information Services Center (GES DISC)** is providing AIRS with support from the AIRS Science Computing Facility (SCF) at JPL, and MLS data via the MLS SIPS at JPL
  - **Atmospheric Science Data Center (ASDC)** is providing MISR data with support from the MISR SCF at JPL
  - **AMSR Science Investigator-led Processing System (SIPS)** is providing AMSR2 data
  - **MODIS Adaptive Processing System (MODAPS)** and **Land SIPS** are providing MODIS and VIIRS Land data
  - **OMI Science Investigator-led Processing System (SIPS)** is providing OMI and OMPS data
  - **MOPITT SIPS** (National Center for Atmospheric Research (NCAR)) is providing MOPITT data
  - **Atmosphere SIPS** (Space Science and Engineering Center (SSEC) University of Wisconsin) is providing VIIRS Atmosphere data

## New Products in NASA LANCE

**MOPITT** Global carbon monoxide (CO) data from the MOPITT (see table 1) are the newest near real-time products available through LANCE. Global CO concentrations vary through activities such as seasonal agricultural burning as well as from natural events such as wildfires and volcanic eruptions. Higher atmospheric CO concentrations can increase levels of ground-based ozone and affect oxygen transport in the blood which can lead to health problems, so these data provide a vital resource for forecasting air quality and atmospheric chemistry.



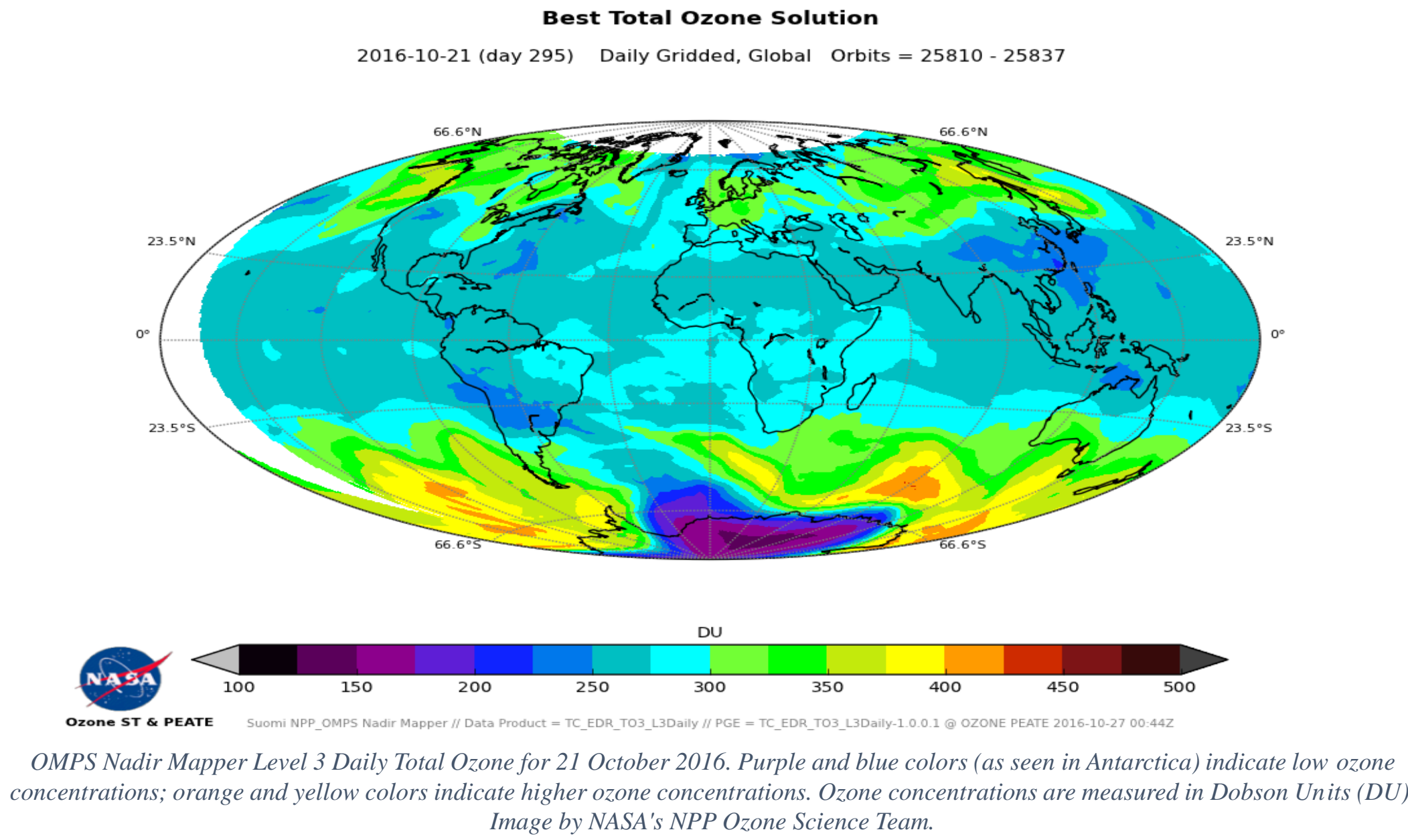
MISR A Nadir, Infrared color (Color Radiance (An, NGB)) image of the Nile River Delta on the 23rd September 2017, shown in NASA's Worldview

## MISR

NRT imagery from MISR (see table 1) is now available through the Global Imagery Browse Services (GIBS) and Worldview. The imagery are available for the nadir, four fore and four aft views provided by MISR's nine cameras. That's looking at the earth from 9 different angles in two different band combinations - a total of 18 imagery products! The NRT MISR data have been available for over a year in LANCE.

## OMPS

Data from the OMPS (see table 1) will be available through LANCE in 2017. The specific products are: Total Column Ozone and Aerosol Index (NMT03), Sulfur Dioxide (NMSO2) and Ozone Profile (NPBUVO3-L2). All three products will provide continuity from OMI.



## FIRMS

The Fire Information for Resource Management System (FIRMS) is being updated. FIRMS distributes global active fire data, in easy to use formats, from VIIRS (375m) and MODIS (1km). The data are available as SHP, TXT and KML as well as via an email alert service, web services and a web mapping interface. The updated version of FIRMS just released in beta is available for testing and feedback on <https://firms2.modaps.eosdis.nasa.gov/>. Additional features will be added in 2018.



## AMSR2

NRT data from AMSR2 (see table 1) provide continuity from Advanced Microwave Sounding Radiometer for EOS (AMSR-E). The NRT AMSR2 products are generated using modified versions of the standard AMSRE product algorithms. These preliminary AMSR2 products are gradually being replaced with AMSR2 standard algorithms but still provided in NRT. The first of these standard algorithms, for Land (Soil Moisture), has replaced the beta NRT algorithm and are now available through LANCE.

## What is in the pipeline?

Over the coming year users can expect to see the following products added to LANCE: Lightning Imaging Sensor data sets, NRT Global Flood products, Black Marble products, additional NRT products from VIIRS (land and atmosphere) and further updates in FIRMS.

## Global Flood Products

NASA's Global Flood Mapping System, located at NASA Goddard Space Flight Center since 2010, is being transitioned to LANCE. Numerous organizations use the flood mapping data to respond to on-going flooding, including the World Food Programme, GeoSur, MapAction, the Federal Emergency Management Agency (FEMA) and the International Red Cross. The surface water extent and flood maps are expected to be available in LANCE in Spring 2018 and will ensure continued service to stakeholders, facilitate processing of the entire MODIS archive, and achieve greater scientific use of the data.

## Black Marble

The VIIRS Black Marble, or nighttime lights layer, captures low-light emissions from a number of sources including city lights, lightning, fishing-fleet navigation lights, gas flares, lava flows and even auroras. In the wake of Hurricane Maria, Miguel Roman (NASA GSFC) and NASA's Short-term Prediction Research and Transition Center (SPoRT) produced hand-crafted Black Marble products to highlight power outages. Groups such as the National Guard and the Federal Emergency Management Agency used these products to help prioritize where to deploy resources. An automated NRT version of the product is expected to be available in LANCE by the end of 2017.

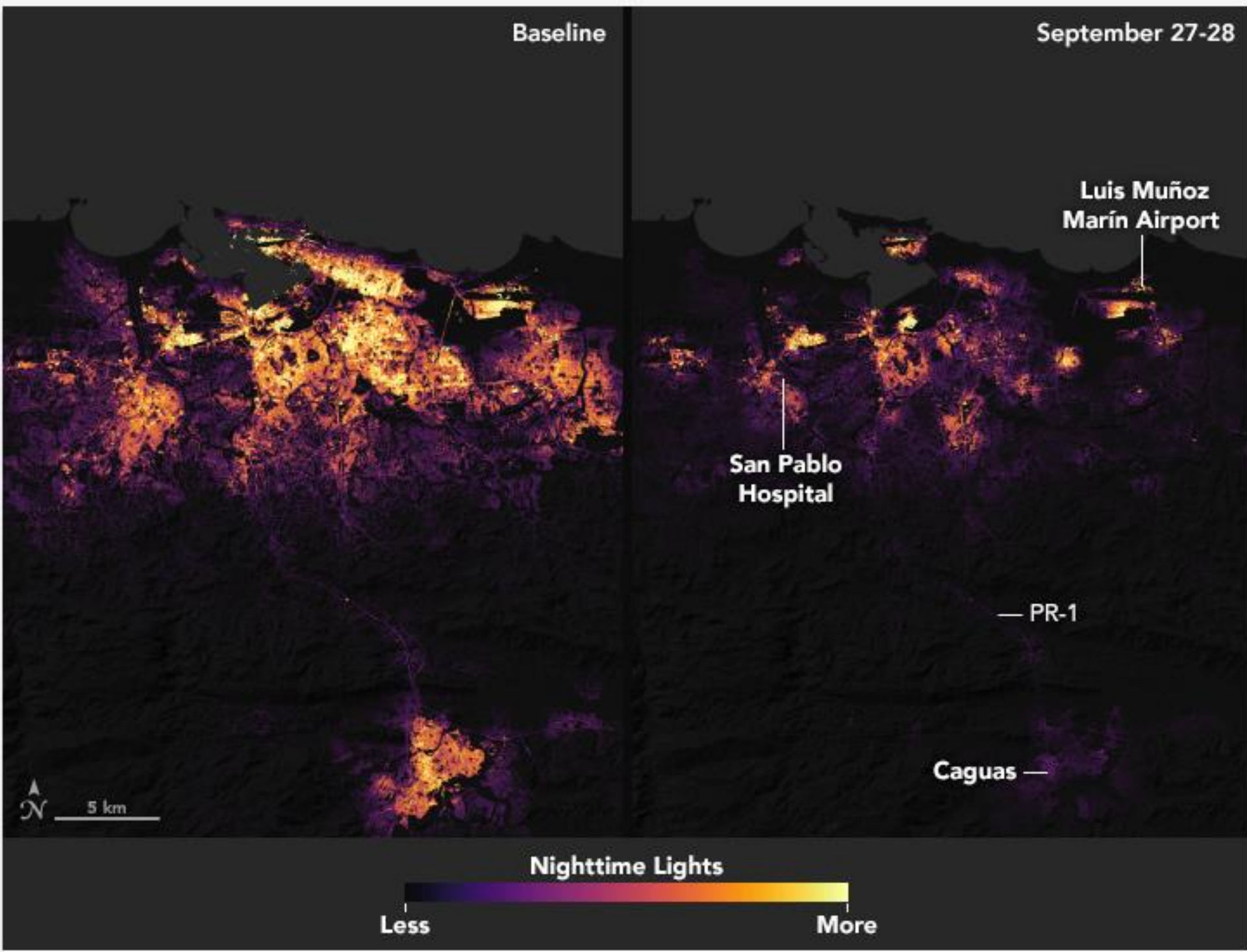


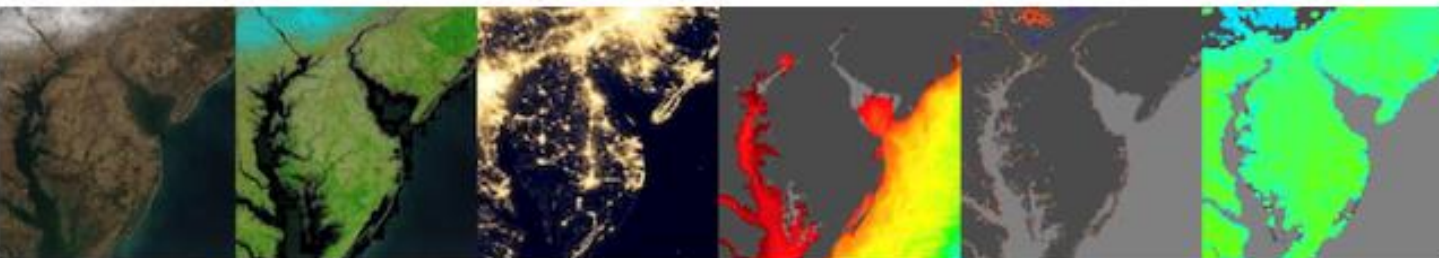
Image courtesy of NASA's Earth Observatory. VIIRS Black Marble, or nighttime light images of Puerto Rico before and after Hurricane Maria tore across the island. The images are based on data captured by the VIIRS day-night band on the S-NPP satellite. The images show widespread outages around San Juan.

## Lightning Imaging Sensor (LIS)

In February 2017 the LIS was placed on the International Space Station (ISS) for a two – four year mission. Data from the LIS will be made available from LANCE with a 2 minute latency using the ISS Low Rate Telemetry channel. The ISS LIS was originally built as the flight spare for NASA's EOS Tropical Rainfall Measuring Mission (TRMM) satellite. The data will be used by a number of NOAA operational partners, including the NWS Pacific Region, NWS Ocean Prediction Center, the NWS Aviation Weather Center, and the NOAA National Hurricane Center.

## Science vs. NRT Data

In order to generate data products within 3 hours of observation time, a number of changes have been made to the standard processing approach to expedite the availability of input data sets. Characterizations of the differences between science and near real-time products reveal some minor differences, but overall the agreement is high. More information on the differences can be found at <https://earthdata.nasa.gov/earth-observation-data/near-real-time/near-real-time-versus-standard-products>



## Accessing LANCE Data and Imagery

For more information and links to data: <https://earthdata.nasa.gov/lance>

Earthdata Search: <https://search.earthdata.nasa.gov>

Worldview: <https://earthdata.nasa.gov/worldview>

Global Imagery Browse Services: <https://earthdata.nasa.gov/gibs>

For Active Fire data: FIRMS: <https://earthdata.nasa.gov/firms>

Contact: [support@earthdata.nasa.gov](mailto:support@earthdata.nasa.gov)

